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# SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF)

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# Opinion by written procedure

# Request for in-year management advice for sandeel in the North Sea and Skagerrak (STECF-OWP-11-02)

**Edited by John Casey & Hendrik Dörner**

FEBRUARY 2011

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**OPINION OF THE SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES BY WRITTEN PROCEDURE**

**Request for in-year management advice for sandeel in the North Sea and Skagerrak**

**FEBRUARY 2011**

## Background and request to STECF

In line with Article 5 and Annex IID of Council Regulation (EC) No 57/2011, the Commission will, if appropriate, prepare an amendment of the TAC for sandeel in the North Sea and Skagerrak for 2011.

On 21 February ICES will deliver its advice for each of the 7 sandeel management areas shown in Appendix 1 of Annex IID of Regulation 57/2011. The STECF is requested to review the ICES advice and to indicate the appropriate level catches in 2011 in each of those management areas. Where ICES is unable to give advice for one or more of the areas, the STECF is requested to indicate whether there is any basis for setting a non-zero catch limit for those areas, and if so, advise on what catch limits would be appropriate.

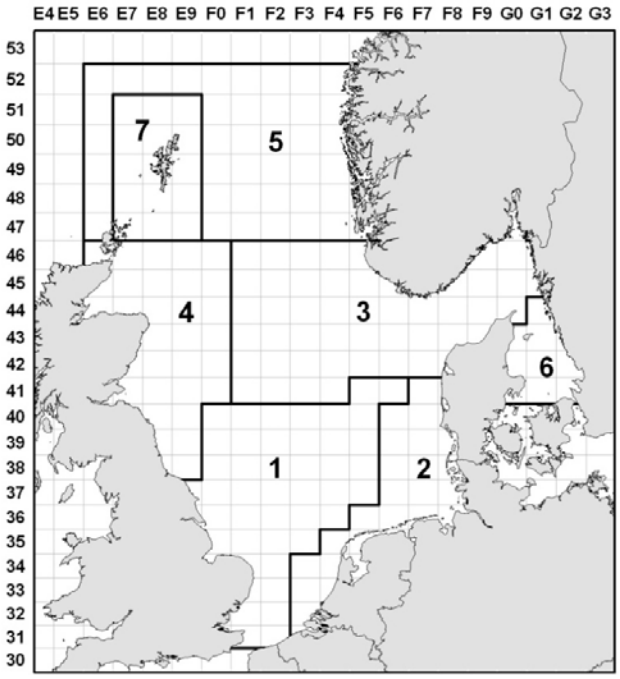
According to Annex IID of Regulation 57/2011, the Commission should endeavour to amend the TAC before 1 March. The STECF is therefore requested to provide its advice by 24 February at the latest.

## STECF Observations and comments

### 1.1 Sandeel (Ammodytidae) in the North Sea (IV), Skagerrak and Kattegat (IIIa)

Prior to 2010, ICES presented advice for this area in three units: North Sea excluding Shetland area, the Shetland area and Skagerrak-Kattegat. Based on the results from a benchmark assessment, September 2010, ICES will present advice for the North Sea sandeel divided into 7 areas from 2010 onwards (see text table below). This change was made to better reflect the stock structure of sandeel in the North Sea and to enable management to direct action avoiding local depletions, as has been repeatedly advised in recent years. The level of information available per area differs and the level of detail per advice will differ accordingly.

| Section | Sandeel Area (SA) | Name | Rectangles |
|---|---|---|---|
| 1.1.1 | 1 | Dogger Bank area | 31-34 E9-F2; 35 E9- F3; 36 E9-F4; 37 E9-F5; 38-40 F0-F5; 41 F5-F6 |
| 1.1.2 | 2 | South Eastern North Sea | 31-34 F3-F4; 35 F4-F6; 36 F5-F8; 37-40 F6-F8; 41 F7-F8 |
| 1.1.3 | 3 | Central Eastern North Sea | 41 F1-F4; 42-43 F1-F9; 44 F1-G0; 45-46 F1-G1; 47 G0 |
| 1.1.4 | 4 | Central Western North Sea | 38-40 E7-E9; 41-46 E6-F0 |
| 1.1.5 | 5 | Viking and Bergen Bank area | 47-51 E6 + F0-F5; 52 E6-F5 |
| 1.1.6 | 6 | Division IIIa East (Kattegat) | 41-43 G0-G3; 44 G1 |
| 1.1.7 | 7 | Shetland area | 47-51 E7-E9 |




**Map of Sandeel Areas (SA)**

Following STECF's review of ICES advice on sandeel provided in October 2010, dredge survey information from December 2010 became available and has been used by ICES to estimate recruitment for 2010 and to conduct forecasts for 2011. Update advice from ICES is given for sandeel areas 1, 2, 3 and 4. For the other three areas ICES advice is unchanged from October 2010.

**FISHERIES:** Sandeel is taken by trawl with codend mesh sizes of less than 16 mm. The fishery is seasonal, taking place from April to July. Most of the catch consists of *Ammodytes marinus*, but other sandeel species are caught as well. By-catch of other species is low. Sandeels are largely stationary after settlement and the sandeel must be considered as a complex of local populations.

The stocks are exploited predominantly by Denmark and Norway, with minor landings taken by the UK, Sweden, Germany and the Faroes. Landings fluctuated between 550,000 t and 1,200,000 t in the period 1980 to 2002 with the highest catches observed in 1997. Catches dropped in 2003 and have since then been well below average reaching a minimum of 177,000 t in 2005. Catches in 2010 amount to 395,000 t. Catch possibilities are largely dependent on the size of the recruiting year-class.

**SOURCE OF MANAGEMENT ADVICE:** The main management advisory body is ICES. Analytical assessments are available for sandeel in Area 1-3. Catches in the remaining areas have been less than 1% of the total since 2005, but considerably higher before 2005. The assessment of the North Sea sandeel is based on a seasonal age-based assessment using total commercial effort and fisheries independent data from dredge surveys.

**MANAGEMENT OBJECTIVES:** No management objectives have been set for this stock. Two management systems are in operation for the sandeel in the North Sea, Skagerrak and Kattegat. The EU management system covers the sandeel fisheries in EU waters and the Norwegian system covers the fisheries in Norwegian waters.

Preliminary quotas for sandeel in EU waters were set agreed by the European Council in December 2010 on the basis of the ICES and STECF autumn 2010 advice. The Council furthermore agreed that the the Commission should endeavour to revise the quotas by 1st of March 2011 based on update advice from ICES and STECF. Additional real time monitoring in the beginning of the fishing season (April) might be necessary to provide catch options for sandeel in Area 3 due to the relatively low quality of the dredge survey in this area.

**RECENT MANAGEMENT ADVICE:**

For short-lived species such as sandeel, the ICES interpretation of the MSY concept uses Bpa estimates as the default value for MSY $B_{escapement}$. Advice is based upon the stock being at least MSY $B_{escapement}$ in the year after the advised fishery has taken place. The escapement strategy should allow for sufficient stock to remain for successful recruitment whilst providing adequate resource for predators of sandeel. ICES provides advice separately for the 7 areas.

**STECF COMMENTS:**

STECF notes the improvements made by ICES on the area based stock assessment of sandeel in the North Sea by applying the new statistical assessment model which makes use total international fishing effort and fishery independent data from dredge surveys.

STECF notes that 2010 dredge survey results were available for Area 1, 2, 3 and 4 but not for the remaining areas. The dredge survey results confirmed a large 2009 year class in Area 1, 2 and 4 and a modest year class in area 3. For all areas covered by the dredge survey the 2010 year class was estimated to be low.

With reference to the Communication from the Commission (COM (2010) 241 FINAL), STECF advises that sandeel in all areas fall under Category 5, because sandeel is short-lived. Because STECF is unable to provide specific advice for management of Area 5-7 sandeel, these stocks may also be classified under Category 11. STECF notes that the rules for Category 11 prescribe that TACs should be adjusted towards recent real catch levels but should not be changed by more than 15% per year or Member States should develop an implementation plan to provide advice within a short time. Furthermore, where appropriate, there should be no increase in fishing effort. STECF notes that the recent catch levels have been zero (Area 5, Viking Bank; Area 7, Shetland) or low (Area 6, Kattegat; average (since the stock collapse in 2003)=423 t). There is no separate TAC by these areas. STECF therefore notes that a way of implementing the rules for category 11 could be "No increase in effort". Such effort limitation would allow higher landings from Area 6 in case of higher recruitment.

Furthermore, STECF notes the ICES approach for MSY based management of a short-lived species as sandeel is the escapement strategy, i.e. to maintain SSB above MSY $B_{escapement}$ after the fishery has taken place. For some areas the ICES preliminary outlook table indicates that the escapement strategy would imply a several-fold increase in F in 2011 if recruitment (age 0) in 2010 is of

average strength. However, taking the historical F and stock development into account, STECF agrees with the ICES recommendation for the development of F reference points (F ceiling).

### 1.1.1 Sandeel (Ammodytidae) in Area-1 (The Dogger bank area)

**REFERENCE POINTS:**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| **MSY Approach** | MSY $B_{escapement}$ | 215 000 t | = $B_{pa}$ |
| | $F_{MSY}$ | Not defined | |
| **Precautionary Approach** | $B_{lim}$ | 160 000 t | Median SSB in the years (2000-2006) of lowest SSB and no impaired recruitment (WKSAN, 2010) |
| | $B_{pa}$ | 215 000 t | $B_{pa}=B_{lim}*exp^{(\sigma*1.645)}$ with σ=0.18 estimated from assessment uncertainty in the terminal year (WKSAN, 2010) |
| | $F_{lim}$ | Not defined | |
| | $F_{pa}$ | Not defined | |

**MANAGEMENT AGREEMENTS:** No specific management objectives are known to STECF.

**STOCK STATUS:**

| | F (Fishing Mortality) | | |
|---|---|---|---|
| | 2008 | 2008 | **2010** |
| **MSY ($F_{msy}$)** | ? | ? | ? |
| **Precautionary approach ($F_{pa}$,$F_{lim}$)** | ? | ? | ? |

| | SSB (Spawning Stock Biomass) | | |
|---|---|---|---|
| | 2009 | 2010 | **2011** |
| **MSY ($B_{escapement}$)** | + | + | + |
| **Precautionary approach ($B_{pa}$,$B_{lim}$)** | + | + | + |

The stock at the start of 2011 is expected to be at full reproductive capacity owing to the large recruitment in 2009. Fishing mortality decreased in 2005 from a high level and has since fluctuated without trend.

**RECENT MANAGEMENT ADVICE:** ICES advises on the basis of the MSY approach that the catch in 2011 should be less than 320 000 t to maintain SSB in 2012 above MSY $B_{escapement}$.

***MSY approach***

Following the ICES MSY framework for a short lived species the fishery in 2011 should allow for sufficient stock (MSY Bescapement) to remain for successful recruitment. This implies a catch of less than 320 000 t in 2011.

***Policy paper***
In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5, because this is a short lived species. ICES notes that the TAC and the stock assessment areas do not match.
***Additional considerations***

*Uncertainties in assessment and forecast*
The dredge survey results are is sufficiently robust to provide a reliable estimate of the incoming 1-group. Hence, fishing opportunities for 2011 can be established based on this information.

*Management plans*
A management plan needs to be developed. The ICES approach for MSY based management of a short-lived species as sandeel is an escapement strategy, i.e. to maintain SSB above MSY Bescapement after the fishery has taken place. With the current MSY Bescapement at Bpa (215 000 t) the outlook table indicates that the 2011 catch according to the MSY approach will require an F at 0.70, which is twice the F value in 2010. However, taking the historical F and stock development into account an F value above 0.6 is probably not recommendable. As effort is assumed proportional to F, effort must be doubled to take the TAC in 2012. A management plan should include an upper limit on effort estimated on the basis of the effort applied in the most recent years.

**STECF COMMENTS:** STECF agrees with the ICES assessment of the state of the stock and the advice for 2011.

See the general STCEF notes on sandeel in the introduction section to sandeel (section 1.1).

### 1.1.2 Sandeel (Ammodytidae) in Area-2 (South Eastern North Sea)

**REFERENCE POINTS:**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| **MSY Approach** | MSY $B_{escapement}$ | 100 000 t | = $B_{pa}$ |
| | $F_{MSY}$ | Not defined | |
| **Precautionary Approach** | $B_{lim}$ | 70 000 t | Median SSB in the years (2000-2006) of lowest SSB and no impaired recruitment (WKSAN, 2010) |
| | $B_{pa}$ | 100 000 t | $B_{pa}=B_{lim}*exp^{(\sigma*1.645)}$ with $\sigma$=0.23 estimated from assessment uncertainty in the terminal year (WKSAN, 2010) |
| | $F_{lim}$ | Not defined | |
| | $F_{pa}$ | Not defined | |

**MANAGEMENT AGREEMENTS:** No specific management objectives are known to STECF.

**STOCK STATUS:**

| F (Fishing Mortality) | | | |
|---|---|---|---|
| | 2008 | 2008 | 2010 |
| MSY ($F_{msy}$) | ? | ? | ? |
| Precautionary approach ($F_{pa}$,$F_{lim}$) | ? | ? | ? |

| | SSB (Spawning Stock Biomass) | | |
|---|---|---|---|
| | 2009 | 2010 | **2011** |
| **MSY** ($B_{escapement}$) | + | − | + |
| **Precautionary approach** ($B_{pa}$,$B_{lim}$) | + | o | + |

Due to low value of F (around 0.1) since 2007 and the strong 2009 year class, SSB in 2011 is estimated more than twice as high as $B_{pa}$.

**RECENT MANAGEMENT ADVICE:** ICES advises on the basis of the MSY approach that catch in 2011 should be less than 34 000 t in 2011 to maintain SSB in 2012 above MSY Bescapement.

***MSY approach***

Following the ICES MSY framework for a short lived species the fishery in 2011 should allow for sufficient stock (MSY Bescapement ) to remain for successful recruitment. This implies a catch of less than 34 000 t in 2011.

***Policy paper***

In light of the EU policy paper on fisheries management (17 May 2010, COM (2010) 241) this stock is classified under category 5, because this is a short-lived species.

***Additional considerations***

*Uncertainties in assessment and forecast*

There appears to be a sufficiently robust relationship between the recruitments in SA 1 and SA 2 to be able to use the same data sources and procedures from SA 1 for the estimation of the incoming year class strength. The dredge survey was expanded in 2010 to cover area 2.*ICES Advice 2011, Book 6* 15.

*Management plans*

A management plan needs to be developed. The ICES approach for MSY based management of a short-lived species as sandeel is the escapement strategy, i.e. to maintain SSB above MSY Bescapement after the fishery has taken place. Such an approach does not include an upper limit on F. However, taking the historical F and stock development into account an F value above 0.4-0.5 is probably not recommendable. Such an F ceiling can be expressed as an effort limit for management usage as fishing mortality is assumed proportional to effort.

**STECF COMMENTS:** STECF agrees with the ICES assessment of the state of the stock and the advice for 2011.

See the general STCEF notes on sandeel in the introduction section to sandeel (section 1.1).

### 1.1.3 Sandeel (Ammodytidae) in Area-3 (Central Eastern North Sea)

**REFERENCE POINTS:**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| **MSY Approach** | MSY $B_{escapement}$ | 195 000 t | = $B_{pa}$ |
| | $F_{MSY}$ | Not defined | |
| **Precautionary Approach** | $B_{lim}$ | 100 000 t | The highest SSB (in 2001) in the period (2001-2007) with the lowest SSB and low recruitment (WKSAN, 2010) |
| | $B_{pa}$ | 195 000 t | $B_{pa}=B_{lim}*exp^{(\sigma*1.645)}$ with σ=0.40 estimated from assessment uncertainty in the terminal year (WKSAN, 2010) |
| | $F_{lim}$ | Not defined | |
| | $F_{pa}$ | Not defined | |

**MANAGEMENT AGREEMENTS:** No specific management objectives are known to ICES.

**STOCK STATUS:**

| F (Fishing Mortality) | 2008 | 2008 | 2010 |
|---|---|---|---|
| MSY ($F_{msy}$) | ? | ? | ? |
| Precautionary approach ($F_{pa}$,$F_{lim}$) | ? | ? | ? |

| SSB (Spawning Stock Biomass) | 2009 | 2010 | 2011 |
|---|---|---|---|
| MSY ($B_{escapement}$) | − | + | + |
| Precautionary approach ($B_{pa}$,$B_{lim}$) | − | + | + |

The stock has increased from the record low SSB in 2004 at half of Blim to above Bpa in 2010. SSB in 2011 is estimated to be below $B_{pa}$. Recruitment was above the long term mean in 2001 and has been below since. F has been below the long term mean since 2004, however highly variable between years.

**RECENT MANAGEMENT ADVICE:** ICES advises on the basis of the MSY approach that no catches of sandeel in area 3 should be allowed in 2011.

***MSY approach***

Following the ICES MSY framework for a short lived species the fishery in 2011 should allow for sufficient stock (MSY Bescapement) to remain for successful recruitment. ICES advises a zero catch in 2011 as even this will not allow SSB to increase above MSY Bescapement in 2012.

***Policy paper***

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5, because this is a short-lived species. ICES notes that the TAC and the stock assessment areas do not match.

***Additional considerations***

*Uncertainties in assessment and forecast*

The assessment is considered less robust than the assessments for SA 1 and SA 2.

No Norwegian effort data are available to ICES with the appropriate resolution. Norwegian fishing effort has therefore been estimated on the basis of Norwegian landings and the assumption that Danish and Norwegian cpue are similar. Observed Norwegian effort would probably increase the quality of the assessment as the Norwegian fleet generallyfishes more northerly than the Danish fleet, especially in the most recent years with Danish limitations on the access to the Norwegian EEZ.

The dredge survey covers mainly the southern part of SA 3. A northerly extension of the survey area and coverage of the Skagerrak area would probably increase the quality of the survey results for assessment purpose.

ICES concluded in 2010 that the dredge survey estimates of the incoming year class appear less robust for area 3 and it is therefore appropriate that in-season monitoring (e.g. acoustic monitoring and age-based commercial cpue) should continue in area 3. The survey index for the 2010 year-class is very low and outside the range of previously observed values; this might reflect a very low recruitment or simply poor survey coverage. However, the ICES advice from October 2010 indicated that even with zero TAC in 2011 a recruitment higher than 60% of long term average would be required to increase SSB above MSY Bescapement in 2012.

**STECF COMMENTS:** STECF agrees with the ICES assessment of the state of the stock and the advice for 2011..

See the general STCEF notes on sandeel in the introduction section to sandeel (section 1.1).

### 1.1.4 Sandeel (Ammodytidae) in Area-4 (Central Western North Sea)

**REFERENCE POINTS:** No reference points are defined for this stock.

**MANAGEMENT AGREEMENTS:** No specific management objectives are known to ICES.

**STOCK STATUS:**

| | F (Fishing Mortality) | | |
|---|---|---|---|
| | 2008 | 2008 | **2010** |
| **MSY ($F_{msy}$)** | ? | ? | ? |
| **Precautionary approach ($F_{pa}$,$F_{lim}$)** | ? | ? | ? |
| **Qualitative evaluation** | → | → | → |

| | SSB (Spawning Stock Biomass) | | |
|---|---|---|---|
| | 2009 | 2010 | **2011** |
| **MSY ($B_{escapement}$)** | ? | ? | ? |
| **Precautionary approach ($B_{pa}$,$B_{lim}$)** | ? | ? | ? |
| **Qualitative evaluation** | ? | ↗ | ↗ |

Catch and survey data are not sufficient for a traditional age-based assessment, however the very limited effort applied in the area indicates a very low fishing mortality. The results from the dredge survey show a high recruitment in 2009 as observed in Areas 1 and 2. This is expected to lead to a considerable increase in SSB for 2011.

**RECENT MANAGEMENT ADVICE:** For 2011, ICES advises that a catch between 5000 and 10 000 tonnes is likely to impose a low risk to the sandeel stock in area 4. This is based on precautionary considerations founded on fishery independent data indicating an increasing stock size in recent years.

***PA considerations***
The fishery independent data indicate that the recruitment was high in 2009 and low in 2010 as observed in SA 1 and SA 2. Given the large 2009 year class and the moratorium of Firth of Forth since 2000, ICES advises that a TAC in the range of 5000–10 000 t is likely to imply a low risk of overfishing while allowing catches at the low end of the historical range.

***Policy paper***
In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5, because this is a short-lived species. ICES notes that the TAC and the stock assessment areas do not match.

**Additional considerations**
It is important to continue the Scottish dredge survey in this area, even though the overlap between this survey and the commercial cpue time series is currently too short to provide reliable estimates of incoming 1-group strength. Little or no information is available for this area from the in-year monitoring system in recent years because of low fishing effort. Until there is sufficient overlap in the time series of dredge survey and commercial data there will be no scientific basis to present a catch forecast.
**STECF COMMENTS:** STECF agrees with the ICES assessment of the state of the stock and the advice for 2011.

See the general STCEF notes on sandeel in the introduction section to sandeel (section 1.1).

### 1.1.5 Sandeel (Ammodytidae) in Area-5 (Viking and Bergen Bank area)

**REFERENCE POINTS:** No reference points are defined for this stock.

**MANAGEMENT AGREEMENTS:** No specific management objectives are known to STECF.

**STOCK STATUS:**

| | F (Fishing Mortality) | | |
|---|---|---|---|
| | 2008 | 2008 | **2010** |
| **MSY ($F_{msy}$)** | ? | ? | ? |
| **Precautionary approach ($F_{pa}$,$F_{lim}$)** | ? | ? | ? |

| | SSB (Spawning Stock Biomass) | | |
|---|---|---|---|
| | 2009 | 2010 | **2011** |
| **MSY ($B_{escapement}$)** | ? | ? | ? |
| **Precautionary approach ($B_{pa}$,$B_{lim}$)** | ? | ? | ? |

Only catch statistics are available for this stock. The available information is inadequate to evaluate stock status or trends. The state of the stock is therefore unknown.

**RECENT MANAGEMENT ADVICE:** There is no basis for an advice. Therefore no increase of the fisheries should take place unless there is evidence that this will be sustainable.

***Policy paper***
In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock assessment area is classified under category 11 because there is no advice for this area

**STECF COMMENTS:** STECF agrees with the ICES assessment that the state of the stock is unknown.

See the general STCEF notes on sandeel in the introduction section to sandeel (section 1.1).

### 1.1.6 Sandeel (Ammodytidae) in Area-6 (Division IIIa East (Kattegat))

**REFERENCE POINTS:** No reference points are defined for this stock.

**MANAGEMENT AGREEMENTS:** No specific management objectives are known to STECF.

**STOCK STATUS:**

| | F (Fishing Mortality) | | |
|---|---|---|---|
| | 2008 | 2008 | 2010 |
| MSY ($F_{msy}$) | ? | ? | ? |
| Precautionary approach ($F_{pa}$,$F_{lim}$) | ? | ? | ? |

| | SSB (Spawning Stock Biomass) | | |
|---|---|---|---|
| | 2009 | 2010 | 2011 |
| MSY ($B_{escapement}$) | ? | ? | ? |
| Precautionary approach ($B_{pa}$,$B_{lim}$) | ? | ? | ? |

Only catch statistics are available for this stock. The available information is inadequate to evaluate stock status or trends. The state of the stock is therefore unknown.

**RECENT MANAGEMENT ADVICE:** There is no basis for an advice. Therefore no increase of the fisheries should take place unless there is evidence that this will be sustainable.

***Policy paper***
In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock assessment area is classified under category 11 because there is no advice for this area. ICES notes that the TAC and the stock assessment areas do not match.

**STECF COMMENTS:** STECF agrees with the ICES assessment that the state of the stock is unknown.

See the general STCEF notes on sandeel in the introduction section to sandeel (section 1.1).

### 1.1.7 Sandeel (Ammodytidae) in Area-7 (Shetland area)

**REFERENCE POINTS:** No reference points are defined for this stock.

**MANAGEMENT AGREEMENTS:** No specific management objectives are known to ICES.

**STOCK STATUS:**

| | F (Fishing Mortality) | | |
|---|---|---|---|
| | 2008 | 2008 | **2010** |
| **MSY ($F_{msy}$)** | ? | ? | ? |
| **Precautionary approach ($F_{pa}$,$F_{lim}$)** | ? | ? | ? |

| | SSB (Spawning Stock Biomass) | | |
|---|---|---|---|
| | 2009 | 2010 | **2011** |
| **MSY ($B_{escapement}$)** | ? | ? | ? |
| **Precautionary approach ($B_{pa}$,$B_{lim}$)** | ? | ? | ? |

Only catch statistics are available for this stock. The available information is inadequate to evaluate stock status or trends. The state of the stock is therefore unknown.

**RECENT MANAGEMENT ADVICE:** There is no basis for an advice.

***Policy paper***
In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock assessment area is classified under category 11 because there is no advice for this area. ICES notes that the TAC and the stock assessment areas do not match.

**STECF COMMENTS:** STECF agrees with the ICES assessment that the state of the stock is unknown.

See the general STCEF notes on sandeel in the introduction section to sandeel (section 1.1).

**ANNEX I.**

# ICES ADVICE 2011, BOOK 6, PAGES 1-32

**ECOREGION** **North Sea**
**STOCK** **Sandeel in Division IIIa and Subarea IV**

Sandeel are largely stationary after settlement and there is a complex of local (sub-) stocks in the North Sea. To avoid local depletion, ICES advice for sandeel is provided for seven areas in Division IIIa and Subarea IV (Figure 6.4.21.1).

| Section | Sandeel Area (SA) | Name | Rectangles |
|---|---|---|---|
| 6.4.21.1 | 1 | Dogger Bank area | 31-34 E9-F2; 35 E9- F3; 36 E9-F4; 37 E9-F5; 38-40 F0-F5; 41 F5-F6 |
| 6.4.21.2 | 2 | South Eastern North Sea | 31-34 F3-F4; 35 F4-F6; 36 F5-F8; 37-40 F6-F8; 41 F7-F8 |
| 6.4.21.3 | 3 | Central Eastern North Sea | 41 F1-F4; 42-43 F1-F9; 44 F1-G0; 45-46 F1-G1; 47 G0 |
| 6.4.21.4 | 4 | Central Western North Sea | 38-40 E7-E9; 41-46 E6-F0 |
| 6.4.21.5 | 5 | Viking and Bergen Bank area | 47-51 E6 + F0-F5; 52 E6-F5 |
| 6.4.21.6 | 6 | Division IIIa East (Kattegat) | 41-43 G0-G3; 44 G1 |
| 6.4.21.7 | 7 | Shetland area | 47-51 E7-E9 |

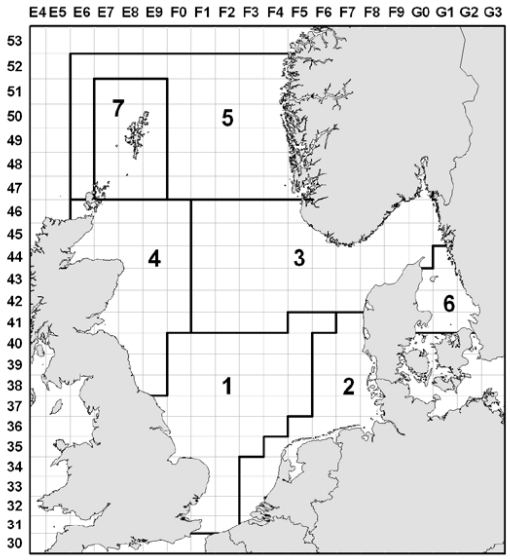



**Figure 6.4.21.1** Sandeel in Division IIIa and Subarea IV. Map of Sandeel Areas (SA).

**Advice for 2011**

Following the ICES advice provided in October 2010, dredge survey information from December 2010 became available and was used to estimate recruitment for 2010 and to conduct forecasts for 2011. Updated advice is given for Sandeel Areas 1, 2, 3 and 4. For the other three areas, the information provided in 2010 is extended. The advice summary for sandeel in different areas is given in sections 6.4.21.1–7. A summary can be found in table 6.4.2.1.1.

Prior to 2010, ICES presented advice for this region in three units: North Sea excluding the Shetland area, the Shetland area and the Skagerrak Kattegat. From 2010 onward, ICES advice is provided for these seven areas to better reflect the stock structure and to enable management to direct action avoiding local depletions, as has been repeatedly advised in recent years. The amount of scientific and fisheries information differs by area and so does the level of detail per advice.

**Table 6.4.21.1** Sandeel in Division IIIa and Subarea IV. Advice overview for all areas.

| Year | Sandeel Area 1 | Sandeel Area 2 | Sandeel Area 3 | Sandeel Area 4 | Sandeel Area 5 | Sandeel Area 6 | Sandeel Area 7 | Agreed TAC [1)] | ICES landings |
|---|---|---|---|---|---|---|---|---|---|
| 2005 [2] | - | - | - | - | - | No advice | No advice | 661 | 172 |
| 2006 [2] | - | - | - | - | - | No advice | No advice | 300 | 288 |
| 2007 [2] | - | - | - | - | - | No advice | No advice | 173 | 206 |
| 2008 [2] | - | - | - | - | - | No advice | No advice | 400 | 335 |
| 2009 [2] | - | - | - | - | - | No advice | No advice | 400 | 347 |
| 2010 | - | - | - | - | - | No advice | No advice | 400 | 398[3] |
| 2011 | < 320 | < 34 | 0 | 5–10 | No advice, no increase in effort unless evidence that this is sustainable | | | | |

Weights in '000 t
[1] Advice for Subarea IV excluding the Shetland area.
[2] Set for zone IIIa, EC waters of Division IIa and Subarea IV.
[3] Preliminary

**Biology**

Sandeel is a short-lived species. The high natural mortality of sandeel and the few age groups in the fishery imply that stock size and catch opportunities are largely dependent on the abundance of incoming year classes. Sandeel are largely stationary after settlement and there is a complex of local (sub-) stocks in the North Sea. Whilst recruitment to individual fishing banks is largely related to the local (sub-) stock, some interchange can occur between (sub-) stocks before sandeel larvae settle.

**Environmental influence on the stock**

Sandeel is a prey for many predators. Changes in the abundances of predators will have affect sandeel natural mortality.

There are indications that the survival of sandeel larvae is linked to the availability of copepod prey in the early spring, especially *Calanus finmarchicus* supports the survival of sandeel larvae, and that climate-generated shifts in the *Calanus* species composition lead to a mismatch in timing between food availability and the early life history of lesser sandeel (Wright and Bailey, 1996; van Deurs *et al.,* 2009).

**The fisheries**

Sandeel is taken by trawlers using small-mesh demersal gear. The fishery is seasonal, taking place mostly in the spring and summer. Most of the catch consists of *Ammodytes marinus*, but other sandeel species are caught as well.

**Effects of the fisheries on the ecosystem**

Sandeel fisheries have a low percentage of bycatch of other fish species, including species for which a TAC has been set (ICES, 2010). A major function of sandeel in the North Sea ecosystem is the provision of food to predators, including fish, marine mammals, and seabirds. As previously noted by ICES, local depletion of sandeel aggregations at a distance less than 100 km from seabird colonies may affect some species of birds, especially black-legged kittiwake and terns, whereas the more mobile marine mammals and fish may be less vulnerable.

**Additional considerations**

*MSY reference points*

For short-lived species such as sandeel, the ICES interpretation of the MSY concept uses $B_{pa}$ estimates as the default value for MSY $B_{escapement}$. ICES advice is based on the sandeel stock being at or above MSY $B_{escapement}$ in the year after the advised fishery has taken place. This escapement strategy should allow for sufficient stock to remain for successful recruitment and providing adequate resource for predators of sandeel.

*Regulations and their effects*

In the light of studies linking low sandeel availability to poor breeding success of kittiwake, all commercial fishing in the Firth of Forth (SA 4) has been prohibited since 2000, except for a limited opening for fishery in May and June of each year to monitor the stock.

Since 2004, sandeel catch regulation has been based on the abundance of 1-group sandeel, as estimated from an exploratory fishery in the beginning of the fishing season.

The number of Danish vessels has declined from 200 vessels in 2004 to 84 in 2009, leading to a 43% reduction in total kilowatt days. In 2007, the Danish industrial vessels were given individual tradable quotas (ITQ) on sandeel which prompted a change towards fewer and larger vessels. The Norwegian fleet fishing for sandeel declined from 90 to 33 vessels between 2002 and 2009.

*Changes in fishing technology and fishing patterns*

Before 2004, a targeted 0-group fishery occurred in autumn (3rd quarter). This fisheries subsequently ceased.

*Uncertainties in assessment and forecast*

The quality of the current assessment is considered much improved compared to the combined assessment for whole North Sea conducted before 2010. This is because the stock assessment areas used now better reflect the actual spatial stock structure and dynamics of sandeel. The use of fishery independent data from dredge surveys has also improved the quality of the assessment. Application of the new statistical assessment model "SMS-effort" in combination with the area-based assessment approach has removed retrospective bias in F and SSB for the most recent years. This is probably due to the robust model assumption of fishing mortality being proportional to fishing effort.

The confidence limits of the model estimates of F, SSB and recruitment indicate a high to medium precision for the SA 1 assessment, a medium precision for the SA 2 assessment and a lower precision for the SA 3 assessment.

The sources of uncertainty within the new assessment and forecast framework are derived from the following sources:

- Use of common, time-invariant natural mortality values over all areas.
- Assumption of correspondence between commercial effort and fishing mortality.
- Observations of effort are only available from the Danish fishery (which also has the largest catches).
- Age and length sampling uncertainty (as with any stock).
- Assumption that the maturity pattern in the forecast year is the long term average.

*Comparison with previous assessment and advice*

The 2010 dredge survey results confirmed a large 2009 year classes in area 1, 2 and 4 and a modest 2009 year class in area 3. For all areas the 2010 year class was estimated to be low.

**Sources**

ICES. 2010. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 5–11 May 2010 ICES CM 2010/ACOM13.

ICES. 2011. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, ICES CM 2011/ACOM13.

van Deurs, M., van Hal, R., Tomczak, M.T., Jónasdóttir, S.H., Dolmer, P. 2009. Recruitment of lesser sandeel *Ammodytes marinus* in relation to density dependence and zooplankton composition. Marine Ecology Progress Series, 381: 249–258.

Wright, P.J., Bailey, M.C. 1996. Timing of hatching in Ammodytes marinus from Shetland waters and its significance to early growth and survivorship. Marine Biology 126:143–152

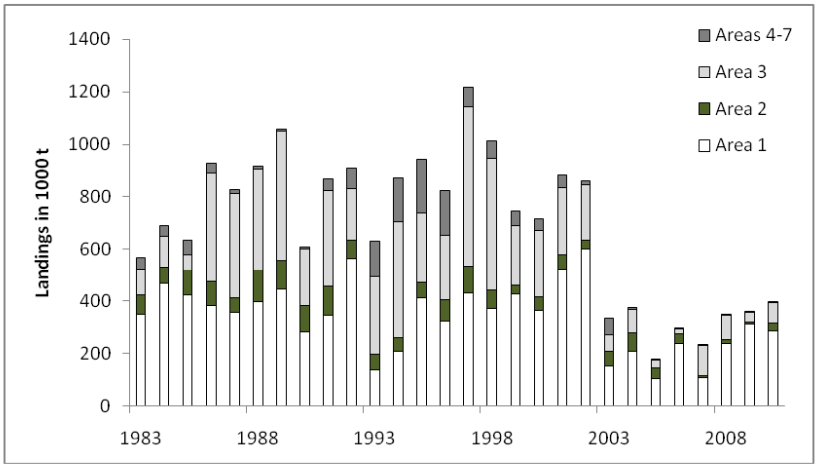



**Figure 6.4.21.2** Sandeel in Division IIIa and Subarea IV. Total landings by Sandeel Area ('000 tonnes).

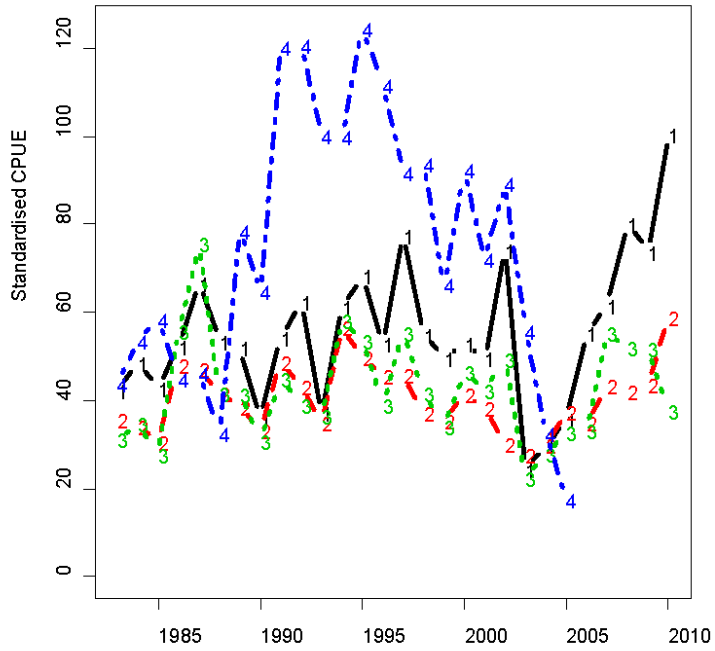



**Figure 6.4.21.3** Sandeel in Division IIIa and Subarea IV. Catch (tonnes) per day fishing for a standardised 200GT vessel for Sandeel Area 1-4. Figure labels correspond to area.

**Table 6.4.21.2** Sandeel in Division IIIa and Subarea IV. Total landings (tonnes) by Sandeel Area reported to ICES. Yield values used for assessments per area are corrected for SOP (Sum of Products of catch numbers by mean weight at age) and hence may differ slightly from landings values in this table.

| Year | SA 1 | SA 2 | SA 3 | SA 4 | SA 5 | SA 6 | SA 7 | All |
|---|---|---|---|---|---|---|---|---|
| **1983** | 349,397 | 74,479 | 100,330 | 2,588 | 2,815 | 0 | 37,201 | 566,810 |
| **1984** | 467,664 | 63,077 | 118,651 | 2,443 | 6,103 | 0 | 33,161 | 691,098 |
| **1985** | 424,058 | 96,658 | 57,835 | 37,060 | 2,929 | 0 | 17,320 | 635,858 |
| **1986** | 382,912 | 93,104 | 414,911 | 12,505 | 10,517 | 0 | 14,023 | 927,973 |
| **1987** | 357,714 | 53,292 | 400,402 | 8,108 | 1,535 | 0 | 7,367 | 828,417 |
| **1988** | 398,221 | 120,387 | 387,994 | 1,324 | 2,450 | 0 | 4,953 | 915,330 |
| **1989** | 446,151 | 109,830 | 492,999 | 4,389 | 2,040 | 909 | 0 | 1,056,318 |
| **1990** | 283,148 | 100,920 | 219,023 | 3,313 | 605 | 499 | 0 | 607,508 |
| **1991** | 347,102 | 107,812 | 368,801 | 41,429 | 2,532 | 17 | 0 | 867,694 |
| **1992** | 564,287 | 69,848 | 195,733 | 68,905 | 4,551 | 4,277 | 0 | 907,600 |
| **1993** | 136,600 | 59,848 | 296,232 | 133,197 | 401 | 4,490 | 0 | 630,768 |
| **1994** | 209,631 | 50,648 | 444,084 | 159,789 | 2,765 | 3,748 | 0 | 870,666 |
| **1995** | 410,687 | 60,143 | 266,720 | 52,759 | 150,637 | 1,830 | 0 | 942,776 |
| **1996** | 324,561 | 80,205 | 250,252 | 162,338 | 6,176 | 1,263 | 0 | 824,796 |
| **1997** | 431,871 | 102,730 | 608,164 | 59,353 | 11,279 | 2,373 | 2,068 | 1,217,839 |
| **1998** | 371,060 | 68,950 | 507,269 | 58,460 | 2,984 | 936 | 5,182 | 1,014,841 |
| **1999** | 428,307 | 32,117 | 228,163 | 53,959 | 140 | 134 | 4,263 | 747,083 |
| **2000** | 363,356 | 52,235 | 256,250 | 37,748 | 325 | 680 | 4,370 | 714,964 |
| **2001** | 521,724 | 58,645 | 253,088 | 47,828 | 1,687 | 312 | 976 | 884,260 |
| **2002** | 599,585 | 35,553 | 209,344 | 12,213 | 10 | 2,378 | 521 | 859,604 |
| **2003** | 150,711 | 56,262 | 62,569 | 64,002 | 44 | 869 | 261 | 334,718 |
| **2004** | 206,696 | 71,426 | 87,695 | 6,915 | 0 | 570 | 0 | 373,302 |
| **2005** | 103,777 | 41,447 | 29,667 | 1,486 | 0 | 262 | 0 | 176,640 |
| **2006** | 238,296 | 35,392 | 18,867 | 85 | 0 | 161 | 0 | 292,802 |
| **2007** | 109,363 | 5,910 | 113,905 | 11 | 4 | 661 | 0 | 229,855 |
| **2008** | 238,523 | 13,065 | 94,576 | 1,201 | 0 | 472 | 0 | 347,836 |
| **2009** | 310,471 | 10,239 | 34,052 | 0 | 0 | 260 | 0 | 355,022 |
| **2010** | 285,794 | 30,530 | 78,067 | 262 | 0 | 132 | 0 | 394,785 |
| **arith. mean** | 337,917 | 62,670 | 235,559 | 36,917 | 7,590 | 973 | 4,702 | 686,327 |

**Table 6.4.21.3** Sandeel in Division IIIa and Subarea IV. Landings ('000 t) per country as provided by Working Group members.

| Year | Denmark | Germany | Faroes | Ireland | Netherlands | Norway | Sweden | UK | Lithuania | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1952 | 1.6 | - | - | - | - | - | - | - | | 1.6 |
| 1953 | 4.5 | + | - | - | - | - | - | - | | 4.5 |
| 1954 | 10.8 | + | - | - | - | - | - | - | | 10.8 |
| 1955 | 37.6 | + | - | - | - | - | - | - | - | 37.6 |
| 1956 | 81.9 | 5.3 | - | - | + | 1.5 | - | - | - | 88.7 |
| 1957 | 73.3 | 25.5 | - | - | 3.7 | 3.2 | - | - | - | 105.7 |
| 1958 | 74.4 | 20.2 | - | - | 1.5 | 4.8 | - | - | - | 100.9 |
| 1959 | 77.1 | 17.4 | - | - | 5.1 | 8.0 | - | - | - | 107.6 |
| 1960 | 100.8 | 7.7 | - | - | + | 12.1 | - | - | - | 120.6 |
| 1961 | 73.6 | 4.5 | - | - | + | 5.1 | - | - | - | 83.2 |
| 1962 | 97.4 | 1.4 | - | - | - | 10.5 | - | - | - | 109.3 |
| 1963 | 134.4 | 16.4 | - | - | - | 11.5 | - | - | - | 162.3 |
| 1964 | 104.7 | 12.9 | - | - | - | 10.4 | - | - | - | 128.0 |
| 1965 | 123.6 | 2.1 | - | - | - | 4.9 | - | - | - | 130.6 |
| 1966 | 138.5 | 4.4 | - | - | - | 0.2 | - | - | - | 143.1 |
| 1967 | 187.4 | 0.3 | - | - | - | 1.0 | - | - | - | 188.7 |
| 1968 | 193.6 | + | - | - | - | 0.1 | - | - | - | 193.7 |
| 1969 | 112.8 | + | - | - | - | - | - | 0.5 | - | 113.3 |
| 1970 | 187.8 | + | - | - | - | + | - | 3.6 | - | 191.4 |
| 1971 | 371.6 | 0.1 | - | - | - | 2.1 | - | 8.3 | - | 382.1 |
| 1972 | 329.0 | + | - | - | - | 18.6 | 8.8 | 2.1 | - | 358.5 |
| 1973 | 273.0 | - | 1.4 | - | - | 17.2 | 1.1 | 4.2 | - | 296.9 |
| 1974 | 424.1 | - | 6.4 | - | - | 78.6 | 0.2 | 15.5 | - | 524.8 |
| 1975 | 355.6 | - | 4.9 | - | - | 54.0 | 0.1 | 13.6 | - | 428.2 |
| 1976 | 424.7 | - | - | - | - | 44.2 | - | 18.7 | - | 487.6 |
| 1977 | 664.3 | - | 11.4 | - | - | 78.7 | 5.7 | 25.5 | - | 785.6 |
| 1978 | 647.5 | - | 12.1 | - | - | 93.5 | 1.2 | 32.5 | - | 786.8 |
| 1979 | 449.8 | - | 13.2 | - | - | 101.4 | - | 13.4 | - | 577.8 |
| 1980 | 542.2 | - | 7.2 | - | - | 144.8 | - | 34.3 | - | 728.5 |
| 1981 | 464.4 | - | 4.9 | - | - | 52.6 | - | 46.7 | - | 568.6 |
| 1982 | 506.9 | - | 4.9 | - | - | 46.5 | 0.4 | 52.2 | - | 610.9 |
| 1983 | 485.1 | - | 2.0 | - | - | 12.2 | 0.2 | 37.0 | - | 536.5 |
| 1984 | 596.3 | - | 11.3 | - | - | 28.3 | - | 32.6 | - | 668.5 |
| 1985 | 587.6 | - | 3.9 | - | - | 13.1 | - | 17.2 | - | 621.8 |
| 1986 | 752.5 | - | 1.2 | - | - | 82.1 | - | 12.0 | - | 847.8 |
| 1987 | 605.4 | - | 18.6 | - | - | 193.4 | - | 7.2 | - | 824.6 |
| 1988 | 686.4 | - | 15.5 | - | - | 185.1 | - | 5.8 | - | 892.8 |
| 1989 | 824.4 | - | 16.6 | - | - | 186.8 | - | 11.5 | - | 1039.1 |
| 1990 | 496.0 | - | 2.2 | - | 0.3 | 88.9 | - | 3.9 | - | 591.3 |
| 1991 | 701.4 | - | 11.2 | - | - | 128.8 | - | 1.2 | - | 842.6 |
| 1992 | 751.1 | - | 9.1 | - | - | 89.3 | 0.5 | 4.9 | - | 854.9 |
| 1993 | 482.2 | - | - | - | - | 95.5 | - | 1.5 | - | 579.2 |
| 1994 | 603.5 | - | 10.3 | - | - | 165.8 | - | 5.9 | - | 785.5 |
| 1995 | 647.8 | - | - | - | - | 263.4 | - | 6.7 | - | 917.9 |
| 1996 | 601.6 | - | 5.0 | - | - | 160.7 | - | 9.7 | - | 776.9 |
| 1997 | 751.9 | - | 11.2 | - | - | 350.1 | - | 24.6 | - | 1137.8 |
| 1998 | 617.8 | - | 11.0 | - | + | 343.3 | 8.5 | 23.8 | - | 1004.4 |
| 1999 | 500.1 | - | 13.2 | 0.4 | + | 187.6 | 22.4 | 11.5 | - | 735.1 |
| 2000 | 541.0 | - | - | - | + | 119.0 | 28.4 | 10.8 | - | 699.1 |
| 2001 | 630.8 | - | - | - | - | 183.0 | 46.5 | 1.3 | - | 861.6 |
| 2002 | 629.7 | - | - | - | - | 176.0 | 0.1 | 4.9 | - | 810.7 |
| 2003 | 274.0 | - | - | - | - | 29.6 | 21.5 | 0.5 | - | 325.6 |
| 2004 | 277.1 | 2.7 | - | - | - | 48.5 | 33.2 | + | - | 361.5 |
| 2005 | 154.8 | - | - | - | - | 17.3 | - | - | - | 172.1 |
| 2006 | 250.6 | 3.2 | - | - | - | 5.6 | 27.8 | - | - | 287.9 |
| 2007 | 144.6 | 1.0 | 2.0 | - | - | 51.1 | 6.6 | 1.0 | - | 206.3 |
| 2008 | 234.4 | 4.4 | 2.4 | - | - | 81.6 | 12.4 | - | - | 335.2 |
| 2009 | 285.7 | 12.2 | 2.5 | - | 1.8 | 27.4 | 12.1 | 3.6 | 2.0 | 347.4 |
| 2010 | 275.1 | 13.0 | - | | | 78.0 | 32.0 | | 0.2* | 398.3* |

* Preliminary

+ = less than half unit.

- = no information or no landings.

**ECOREGION** North Sea
**STOCK** Sandeel in the Dogger Bank area (SA 1)

**Advice for 2011**

ICES advises on the basis of the MSY approach that the catch in 2011 should be less than 320 000 t to maintain SSB in 2012 above MSY $B_{escapement}$.

To protect the stock on a local scale, management should be implemented on the area level.

**Stock status**

| F (Fishing Mortality) | 2008 | 2009 | 2010 |
|---|---|---|---|
| MSY ($F_{MSY}$) | ? | ? | ? Undefined |
| Precautionary approach ($F_{pa}$,$F_{lim}$) | ? | ? | ? Undefined |

| SSB (Spawning Stock Biomass) | 2009 | 2010 | 2011 |
|---|---|---|---|
| MSY ($B_{escapement}$) | ✓ | ✓ | ✓ Above trigger |
| Precautionary approach ($B_{pa}$,$B_{lim}$) | ✓ | ✓ | ✓ Full reproductive capacity |

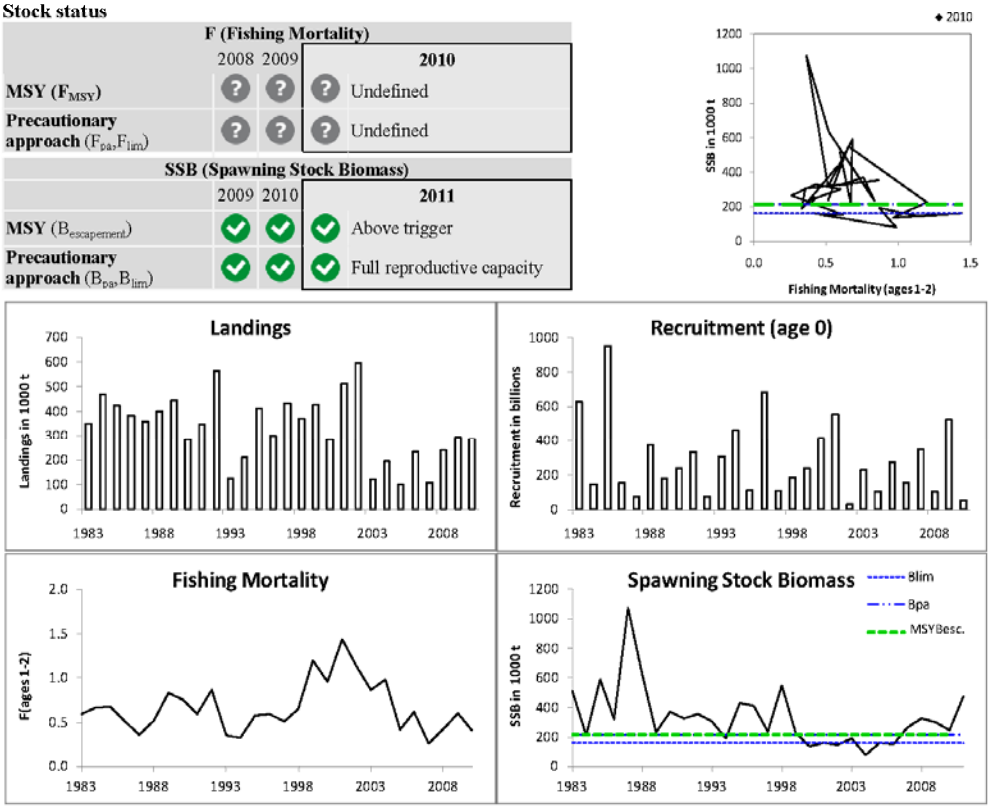



**Figure 6.4.21.1.1** Sandeel in the DoggerBank area (SA1). Summary of stock assessment (weights in '000 t). Top right: SSB and F over the years.

The stock at the start of 2011 is expected to be at full reproductive capacity owing to the large recruitment in 2009. Fishing mortality decreased in 2005 from a high level and has since fluctuated without trend.

**Management plans**

No specific management objectives are known to ICES.

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5. ICES notes that the TAC and the stock assessment areas do not match.

**Fisheries**

| | |
|---|---|
| **Catch by fleet** | Total catch (2010) 286 kt where 100% landings by industrial fisheries |

**Quality considerations**

The December 2010 dredge survey results confirmed the very large 2009 year class observed in the fishery in 2010. Although there is high uncertainty on the absolute size of the 2010 year class, the survey index suggests that this cohort is likely to be in the very low end of the historical time series.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Seasonal age based analytical (SMS-effort) |
| **Input data** | 1 survey index in December (Dredge survey 2004-)<br>Total international fishing effort |
| **Discards and bycatch** | Not included in the assessment |
| **Indicators** | None |
| **Other information** | Last benchmark in 2010. |
| **Working group report** | WGNSSK |

**ECOREGION** North Sea
**STOCK** Sandeel in the Dogger Bank area (SA 1)

**Reference points**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| **MSY Approach** | MSY $B_{escapement}$ | 215 000 t | = $B_{pa}$ |
| | $F_{MSY}$ | Not defined | |
| **Precautionary Approach** | $B_{lim}$ | 160 000 t | Median SSB in the years (2000–2006) of lowest SSB and no impaired recruitment (ICES, 2010) |
| | $B_{pa}$ | 215 000 t | $B_{pa}=B_{lim}*\exp^{(\sigma*1.645)}$ with σ=0.18 estimated from assessment uncertainty in the terminal year (ICES, 2010) |
| | $F_{lim}$ | Not defined | |
| | $F_{pa}$ | Not defined | |

*(unchanged since: 2010)*

**Outlook for 2011**

Basis: Fsq=F(2010)=0.34; Yield(2010)=286; Recruitment(2010)=50 billion; Recruitment(2011)= geometric mean (GM 83-09) = 223 billion; SSB(2011)=430

| Rationale | Landings (2011) | Basis | F (2011) | SSB (2012) | %SSB change[1] |
|---|---|---|---|---|---|
| Zero catch | 0 | F=0 | 0 | 410 | -4% |
| | 50 | Fsq*0.25 | 0.08 | 380 | -11% |
| | 96 | Fsq*0.50 | 0.17 | 350 | -18% |
| | 140 | Fsq*0.75 | 0.25 | 330 | -24% |
| Status quo | 180 | Fsq*1 | 0.34 | 300 | -30% |
| | 210 | Fsq*1.25 | 0.42 | 280 | -35% |
| | 250 | Fsq*1.50 | 0.50 | 260 | -40% |
| | 280 | Fsq*1.75 | 0.59 | 240 | -45% |
| | 310 | Fsq*2 | 0.67 | 220 | -49% |
| MSY-approach | 320 | Fsq*2.08 | 0.70 | 220 | -50% |

Weights in '000 t.
[1)] SSB 2012 relative to SSB 2011.

***MSY approach***
Following the ICES MSY framework for a short lived species the fishery in 2011 should allow for sufficient stock (MSY $B_{escapement}$ ) to remain for successful recruitment. This implies a catch of less than 320 000 t in 2011.

***Policy paper***
In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5, because this is a short lived species. ICES notes that the TAC and the stock assessment areas do not match.

**Additional considerations**

*Uncertainties in assessment and forecast*

The dredge survey results are is sufficiently robust to provide a reliable estimate of the incoming 1-group. Hence, fishing opportunities for 2011 can be established based on this information.

*Management plans*

A management plan needs to be developed. The ICES approach for MSY based management of a short-lived species as sandeel is an escapement strategy, i.e. to maintain SSB above MSY $B_{escapement}$ after the fishery has taken place. With the current MSY $B_{escapement}$ at $B_{pa}$ (215 000 t) the outlook table indicates that the 2011 catch according to the MSY approach will require an F at 0.70, which is twice the F value in 2010. However, taking the historical F and stock development into account an F value above 0.6 is probably not recommendable. As effort is assumed proportional to F, effort must be doubled to take the TAC in 2012. A management plan should include an upper limit on effort estimated on the basis of the effort applied in the most recent years.

**Sources**


ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.

ICES. 2011. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, ICES CM 2011/ACOM13.

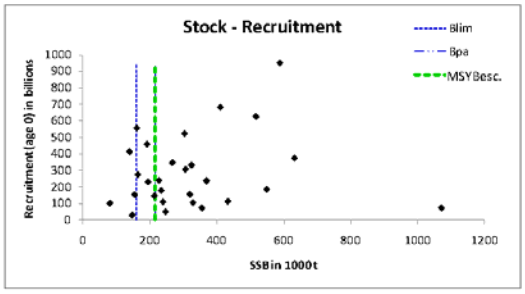




**Figure 6.4.21.1.2** Sandeel in the Dogger Bank area (SA1). Stock–recruitment plot.

**Table 6.4.21.1.1** Sandeel in the Dogger Bank area (SA1). ICES advice, management and landings

| Year | ICES Advice | Catch corresponding to advice | TAC [2] | ICES Landings SA1 | ICES Landings Total |
|---|---|---|---|---|---|
| 2005 [1] | Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class | - | 661 | 104 | 172 |
| 2006 [1] | The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2007. | - | 300 | 238 | 288 |
| 2007 [1] | The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2008. | - | 173 | 109 | 206 |
| 2008 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2009. | - | 400 | 239 | 335 |
| 2009 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2010 | - | 400 | 310 | 347 |
| 2010 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2011 | - | 400 | 286 | 402 |
| 2011 | MSY approach: allow for sufficient stock ($MSY\ B_{escapement}$) to remain for successful recruitment. | < 320 | | | |

Weights in '000 t.

[1] Advice for Subarea IV excluding the Shetland area.

[2] Set for zone IIIa, EC waters of Division IIa and Subarea IV.

**Table 6.4.21.1.4** Sandeel in the Dogger Bank area (SA1). Summary of the assessment.

| Year | Recruits (million) | TSB (tonnes) | SSB (tonnes) | Yield (tonnes) | Mean F ages 1-2 |
|---|---|---|---|---|---|
| **1983** | 624999 | 705504 | 516578 | 349232 | 0.593 |
| **1984** | 146868 | 1502250 | 212681 | 467609 | 0.671 |
| **1985** | 949287 | 1002100 | 588145 | 424114 | 0.679 |
| **1986** | 154159 | 2291220 | 318719 | 382735 | 0.513 |
| **1987** | 73517 | 1607230 | 1071200 | 357671 | 0.362 |
| **1988** | 374394 | 782061 | 631713 | 398271 | 0.518 |
| **1989** | 178837 | 816099 | 232759 | 445695 | 0.833 |
| **1990** | 237255 | 705553 | 368557 | 283040 | 0.759 |
| **1991** | 333141 | 1083600 | 323676 | 347096 | 0.590 |
| **1992** | 73641 | 1315990 | 354859 | 564298 | 0.864 |
| **1993** | 307426 | 551211 | 305634 | 124082 | 0.352 |
| **1994** | 458848 | 826458 | 190239 | 209538 | 0.331 |
| **1995** | 112303 | 1802890 | 432631 | 410513 | 0.578 |
| **1996** | 682124 | 699271 | 410037 | 298702 | 0.589 |
| **1997** | 108893 | 2102340 | 238242 | 431808 | 0.511 |
| **1998** | 185283 | 899570 | 548917 | 371117 | 0.652 |
| **1999** | 240085 | 606838 | 225830 | 427691 | 1.198 |
| **2000** | 414021 | 704641 | 138388 | 284521 | 0.960 |
| **2001** | 556016 | 873627 | 159572 | 513068 | 1.437 |
| **2002** | 29121 | 1376710 | 145830 | 596049 | 1.136 |
| **2003** | 230977 | 265522 | 193364 | 121863 | 0.865 |
| **2004** | 101371 | 508802 | 79690 | 195274 | 0.983 |
| **2005** | 274993 | 400372 | 162804 | 100835 | 0.418 |
| **2006** | 152165 | 772613 | 153474 | 231448 | 0.616 |
| **2007** | 347812 | 598874 | 266195 | 108600 | 0.258 |
| **2008** | 104680 | 1151790 | 328004 | 237447 | 0.427 |
| **2009** | 523224 | 671086 | 302830 | 291247 | 0.598 |
| **2010** | 49689 | 1534960 | 246330 | 285540 | 0.407 |
| **2011** | | | 473850 | | |
| **arith. Mean** | 286612 | 1005685 | 331750 | 330682 | 0.668 |
| **geo. Mean**[1] | 222948 | | | | |

1) Period 1983-2009

**ECOREGION** North Sea
**STOCK** Sandeel in the South Eastern North Sea (SA 2)

**Advice for 2011**

ICES advises on the basis of the MSY approach that catch in 2011 should be less than 34 000 t in 2011 to maintain SSB in 2012 above MSY $B_{escapement}$.

To protect the stock on a local scale, management should be implemented on the area level.

**Stock status**

| F (Fishing Mortality) | 2008 | 2009 | 2010 |
|---|---|---|---|
| MSY ($F_{MSY}$) | ? | ? | ? Undefined |
| Precautionary approach ($F_{pa}$,$F_{lim}$) | ? | ? | ? Undefined |

| SSB (Spawning Stock Biomass) | 2009 | 2010 | 2011 |
|---|---|---|---|
| MSY ($B_{escapement}$) | ✓ | ✗ | ✓ Above trigger |
| Precautionary approach ($B_{pa}$,$B_{lim}$) | ✓ | o | ✓ Full reproductive capacity |

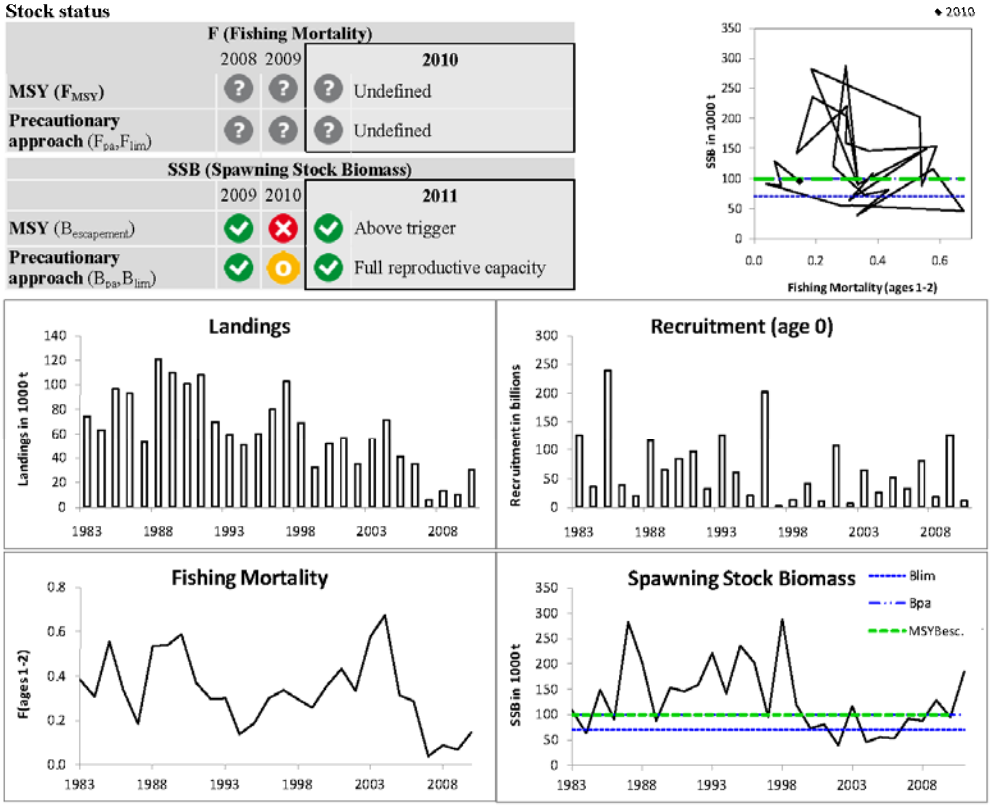



**Figure 6.4.21.2.1** Sandeel in the South Eastern North Sea (SA2). Summary of stock assessment (weights in '000 t). Top right: SSB and F over the years

Due to low values of F (~ 0.1) since 2007 and the strong 2009 year class, SSB in 2011 is estimated around twice as high as $B_{pa}$.

**Management plans**

No specific management objectives are known to ICES.

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5. ICES notes that the TAC and the stock assessment areas do not match.

**Fisheries**

| | |
|---|---|
| **Catch by fleet** | Total catch (2010) 31 kt where 100 % landings by industrial fisheries. |

**Quality considerations**

The December 2010 dredge survey results confirmed the very large 2009 year class observed in the fishery in 2010. Although there is high uncertainty on the absolute size of the 2010 year class, the survey index suggests that this cohort is likely to be in the very low end of the historical time series.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Seasonal age based analytical (SMS-effort) |
| **Input data** | 1 survey index (Dredge survey, 2004-) from Area 1 is applied<br>Total international fishing effort |
| **Discards and bycatch** | Not included in the assessment |
| **Indicators** | None |
| **Other information** | Last benchmark in 2010. |
| **Working group report** | WGNSSK |

**ECOREGION** North Sea
**STOCK** Sandeel in the South Eastern North Sea (SA 2)

**Reference points**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| **MSY Approach** | MSY $B_{escapement}$ | 100 000 t | = $B_{pa}$ |
| | $F_{MSY}$ | Not defined | |
| **Precautionary Approach** | $B_{lim}$ | 70 000 t | Median SSB in the years (2000–2006) of lowest SSB and no impaired recruitment (ICES, 2010) |
| | $B_{pa}$ | 100 000 t | $B_{pa}=B_{lim}*\exp^{(\sigma*1.645)}$ with σ=0.23 estimated from assessment uncertainty in the terminal year (ICES, 2010) |
| | $F_{lim}$ | Not defined | |
| | $F_{pa}$ | Not defined | |

*(unchanged since: 2010)*

**Outlook for 2011**

Basis: Fsq=F(2010)=0.14; Yield(2010)=31; Recruitment(2010)=11 billion; Recruitment(2011)= geometric mean (GM 83-09) = 45 billion; SSB(2011)=188.

| Rationale | Landings (2011) | Basis | F (2011) | SSB (2012) | %SSB change[1] |
|---|---|---|---|---|---|
| Zero Catch | 0 | F=0 | 0 | 130 | -33% |
| | 7 | Fsq*0.25 | 0.04 | 120 | -36% |
| | 13 | Fsq*0.50 | 0.07 | 120 | -38% |
| | 19 | Fsq*0.75 | 0.11 | 110 | -41% |
| Status quo | 25 | Fsq*1 | 0.14 | 110 | -43% |
| | 31 | Fsq*1.25 | 0.18 | 100 | -45% |
| MSY-approach | 34 | Fsq*1.40 | 0.20 | 100 | -47% |
| | 36 | Fsq*1.50 | 0.21 | 98 | -48% |
| | 41 | Fsq*1.75 | 0.25 | 94 | -50% |
| | 47 | Fsq*2 | 0.28 | 90 | -52% |

Weights in '000 t.
[1)] SSB 2012 relative to SSB 2011.

***MSY approach***

Following the ICES MSY framework for a short lived species the fishery in 2011 should allow for sufficient stock (MSY $B_{escapement}$ ) to remain for successful recruitment. This implies a catch of less than 34 000 t in 2011.

***Policy paper***

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5, because this is a short-lived species. ICES notes that the TAC and the stock assessment areas do not match.

**Additional considerations**

*Uncertainties in assessment and forecast*

There appears to be a sufficiently robust relationship between the recruitments in SA 1 and SA 2 to be able to use the same data sources and procedures from SA 1 for the estimation of the incoming year class strength. The dredge survey was expanded in 2010 to cover area 2.

*Management plans*

A management plan needs to be developed. The ICES approach for MSY based management of a short-lived species as sandeel is the escapement strategy, i.e. to maintain SSB above MSY $B_{escapement}$ after the fishery has taken place. Such an approach does not include an upper limit on F. However, taking the historical F and stock development into account an F value above 0.4-0.5 is probably not recommendable. Such an F ceiling can be expressed as an effort limit for management usage as fishing mortality is assumed proportional to effort.

**Sources**


ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.

ICES. 2011. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, ICES CM 2011/ACOM:13.

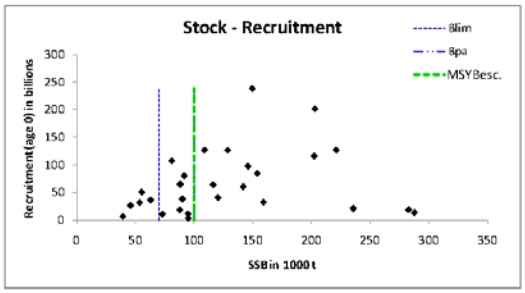




**Figure 6.4.21.2.2** Sandeel in the South Eastern North Sea (SA2). Stock–recruitment plot.

**Table 6.4.21.2.1** Sandeel in the South Eastern North Sea (SA2). ICES advice, management and landings

| Year | ICES Advice | Catch corresponding to advice | TAC [2] | ICES Landings SA2 | ICES Landings Total |
|---|---|---|---|---|---|
| 2005 [1] | Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class | - | 661 | 41 | 172 |
| 2006 [1] | The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2007. | - | 300 | 35 | 288 |
| 2007 [1] | The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2008. | - | 173 | 6 | 206 |
| 2008 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2009. | - | 400 | 13 | 335 |
| 2009 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2010 | - | 400 | 10 | 347 |
| 2010 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2011 | - | 400 | 31 | 402 |
| 2011 | MSY approach: allow for sufficient stock ($MSY\ B_{escapement}$) to remain for successful recruitment. | < 34 | | | |

Weights in '000 t.

[1] Advice for Subarea IV excluding the Shetland area.

[2] Set for zone IIIa, EC waters of Division IIa and Subarea IV.

**Table 6.4.21.2.4** Sandeel in the South Eastern North Sea (SA2). Summary of the assessment.

| Year | Recruits (million) | TSB (tonnes) | SSB (tonnes) | Yield (tonnes) | Mean F ages 1-2 |
|---|---|---|---|---|---|
| **1983** | 127058 | 151775 | 108802 | 74481 | 0.383 |
| **1984** | 36278 | 326571 | 62947 | 63046 | 0.306 |
| **1985** | 238563 | 248260 | 149408 | 96645 | 0.555 |
| **1986** | 38332 | 586268 | 90031 | 93146 | 0.335 |
| **1987** | 18705 | 415460 | 282628 | 53284 | 0.184 |
| **1988** | 116061 | 240438 | 202090 | 120382 | 0.535 |
| **1989** | 64956 | 271447 | 88007 | 109703 | 0.540 |
| **1990** | 84749 | 277160 | 153555 | 100917 | 0.587 |
| **1991** | 97869 | 418513 | 145842 | 107795 | 0.369 |
| **1992** | 32427 | 436339 | 159113 | 69825 | 0.297 |
| **1993** | 126814 | 353954 | 220981 | 59652 | 0.301 |
| **1994** | 60542 | 516387 | 141866 | 50656 | 0.138 |
| **1995** | 20914 | 452347 | 235459 | 60138 | 0.188 |
| **1996** | 201859 | 309225 | 202961 | 80012 | 0.300 |
| **1997** | 3145 | 649194 | 94993 | 102726 | 0.335 |
| **1998** | 13433 | 349607 | 287570 | 68953 | 0.296 |
| **1999** | 40814 | 177520 | 120354 | 32108 | 0.256 |
| **2000** | 10702 | 236062 | 73132 | 52228 | 0.355 |
| **2001** | 107467 | 134520 | 80838 | 56934 | 0.433 |
| **2002** | 6658 | 318847 | 39240 | 35494 | 0.332 |
| **2003** | 63967 | 159762 | 116110 | 55924 | 0.576 |
| **2004** | 26297 | 228285 | 45770 | 71413 | 0.676 |
| **2005** | 50677 | 135432 | 55374 | 41420 | 0.315 |
| **2006** | 31683 | 220979 | 53449 | 35351 | 0.286 |
| **2007** | 80246 | 208715 | 91560 | 5911 | 0.039 |
| **2008** | 18446 | 308837 | 87941 | 13064 | 0.088 |
| **2009** | 126414 | 193851 | 128541 | 10240 | 0.067 |
| **2010** | 11481 | 401504 | 94852 | 30531 | 0.147 |
| **2011** | | | 184604 | | |
| **arith. mean** | 66306 | 311688 | 130966 | 62571 | 0.329 |
| **geo. mean**[1] | 44626 | | | | |

1) Period 1983–2009

**ECOREGION** North Sea
**STOCK** Sandeel in the Central Eastern North Sea (SA 3)

**Advice for 2011**

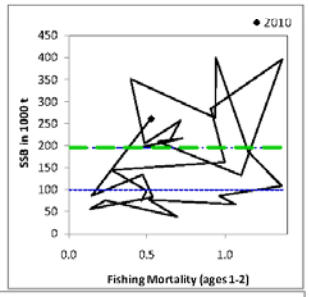
ICES advises on the basis of the MSY approach that no catches of sandeel in area 3 should be allowed in 2011.

To protect the stock on a local scale, management should be implemented on the area level.

**Stock status**

| F (Fishing Mortality) | 2008 | 2009 | 2010 |
|---|---|---|---|
| MSY ($F_{MSY}$) | ? | ? | ? Undefined |
| Precautionary approach ($F_{pa}$,$F_{lim}$) | ? | ? | ? Undefined |

| SSB (Spawning Stock Biomass) | 2009 | 2010 | 2011 |
|---|---|---|---|
| MSY ($B_{escapement}$) | ✗ | ✓ | ✓ Above trigger |
| Precautionary approach ($B_{pa}$,$B_{lim}$) | ✗ | ✓ | ✓ Full reproductive capacity |



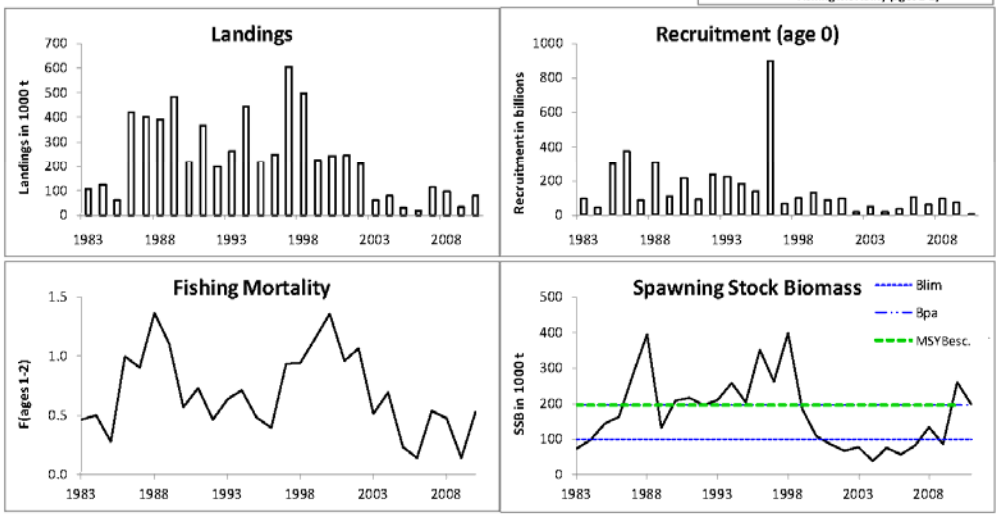




**Figure 6.4.21.3.1** Sandeel in the Central Eastern North Sea (SA3). Summary of stock assessment (weights in '000 tonnes). Top right: SSB and F over the years.

The stock has increased from a record low SSB in 2004 (at half of $B_{lim}$) to above $B_{pa}$ in 2010. SSB in 2011 is estimated to be just above $B_{pa}$ and MSY $B_{escapement}$. Recruitment was above the long term mean in 2001 and has been below since with a very low recruitment in 2010. Since 2004, F has been highly variable between years and below the long-term mean.

**Management plans**

No specific management objectives are known to ICES.

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5. ICES notes that the TAC and the stock assessment areas do not match.

**The fisheries**

| | |
|---|---|
| **Catch by fleet** | Total catch (2010) 78 kt where 100 % landings by industrial fisheries |

**Quality considerations**

The assessment is considered less robust than the assessments for SA 1 and SA 2. The dredge survey only covers the southern part of Area 3. Therefore the very low estimate of recruitment in 2010 is considered uncertain.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Seasonal age based analytical (SMS-effort) |
| **Input data** | 1 survey index available in January (Dredge survey, 2004-)<br>Total international catch and effort |
| **Discards and bycatch** | Not included in the assessment |
| **Indicators** | None |
| **Other information** | Last benchmark in 2010. |
| **Working group report** | WGNSSK |

**ECOREGION** North Sea
**STOCK** Sandeel in the Central Eastern North Sea (SA 3)

**Reference points**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| **MSY Approach** | MSY $B_{escapement}$ | 195 000 t | = $B_{pa}$ |
| | $F_{MSY}$ | Not defined | |
| **Precautionary Approach** | $B_{lim}$ | 100 000 t | The highest SSB (in 2001) in the period (2001–2007) with the lowest SSB and low recruitment (ICES, 2010) |
| | $B_{pa}$ | 195 000 t | $B_{pa}=B_{lim}*\exp^{(\sigma*1.645)}$ with σ=0.40 estimated from assessment uncertainty in the terminal year (ICES, 2010) |
| | $F_{lim}$ | Not defined | |
| | $F_{pa}$ | Not defined | |

*(unchanged since: 2010)*

**Outlook for 2011**

Basis: Fsq=F(2010)=0.43; Yield(2010)=78; Recruitment(2010)=4 billion; Recruitment(2011)= geometric mean (GM 83-09) = 105 billion; SSB(2011)=166.

| **Rationale** | **Landings (2011)** | **Basis** | **F (2011)** | **SSB (2012)** | **%SSB change[1]** |
|---|---|---|---|---|---|
| Zero catch | 0 | F=0 | 0 | 120 | -27% |
| | 10 | Fsq*0.25 | 0.10 | 110 | -32% |
| | 20 | Fsq*0.50 | 0.22 | 110 | -36% |
| | 29 | Fsq*0.75 | 0.32 | 100 | -40% |
| | 37 | Fsq*1 | 0.43 | 95 | -43% |
| | 45 | Fsq*1.25 | 0.54 | 89 | -46% |
| | 53 | Fsq*1.50 | 0.64 | 84 | -49% |

Weights in '000 t.
[1)] SSB 2012 relative to SSB 2011.

***MSY approach***

Following the ICES MSY framework for a short lived species the fishery in 2011 should allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment. ICES advises a zero catch in 2011 as even this will not allow SSB to increase above MSY $B_{escapement}$ in 2012.

***Policy paper***

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5, because this is a short-lived species. ICES notes that the TAC and the stock assessment areas do not match.

**Additional considerations**

*Uncertainties in assessment and forecast*

The assessment is considered less robust than the assessments for SA 1 and SA 2.

No Norwegian effort data are available to ICES with the appropriate resolution. Norwegian fishing effort has therefore been estimated on the basis of Norwegian landings and the assumption that Danish and Norwegian cpue are similar. Observed Norwegian effort would probably increase the quality of the assessment as the Norwegian fleet generally

fishes more northerly than the Danish fleet, especially in the most recent years with Danish limitations on the access to the Norwegian EEZ.

The dredge survey covers mainly the southern part of SA 3. A northerly extension of the survey area and coverage of the Skagerrak area would probably increase the quality of the survey results for assessment purpose.

The Benchmark group (ICES, 2010) concluded that the dredge survey estimates of the incoming year class appear less robust for area 3 and it is therefore appropriate that in-season monitoring (e.g. acoustic monitoring and age-based commercial cpue) should continue in area 3. The survey index for the 2010 year-class is very low and outside the range of previously observed values; this might reflect a very low recruitment or simply poor survey coverage. However, the ICES advice from October 2010 indicated that even with zero TAC in 2011 a recruitment higher than 60% of long term average would be required to increase SSB above MSY $B_{escapement}$ in 2012.

*Management considerations*

Extension of the area covered by the dredge survey will probably reduce the assessment uncertainty.

Pre-season estimates of the incoming year class appear less robust for this area and it is therefore appropriate that in-season monitoring (e.g. acoustic monitoring and age-based commercial cpue) to continue in SA 3. The quality (internal and external consistency) of the acoustic survey is not yet known and the dredge survey results in SA 3 are less consistent than in the other areas.

Norway has set a national quota at 60 000 t in 2011 in three management boxes in the Norwegian EEZ in SA 3, whereas two other management boxes will remain closed. The Norwegian quota is based on acoustic monitoring in April/May 2010. An upcoming acoustic survey in April/May 2011 in Norwegian EEZ will update the information on the stock status; however, the estimated stock abundance from the survey will not be used to change the national quota in SA 3. The sandeel fishery in the Norwegian EEZ was closed in 2009 and no effort data from the 2010 fishery in the Norwegian EEZ were included in the ICES estimates for SA 3. This renders the assessment highly uncertain.

The Norwegian management plan is based on preserving local spawning stocks using a rotational system of opening and closing fishing grounds. The Norwegian EEZ has been divided into six areas, five of which are located in SA 3. If the abundance of sandeel in an area is above a predefined level, half of the area will be opened for fishing. If sandeel abundance remains above the predefined level, the second half of the area will be opened for fishing the following year and the first half will then be closed. ICES has not evaluated the Norwegian management plan for sandeel in the Norwegian part of SA 3.

**Sources**

ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.

ICES. 2011. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, ICES CM 2011/ACOM13.

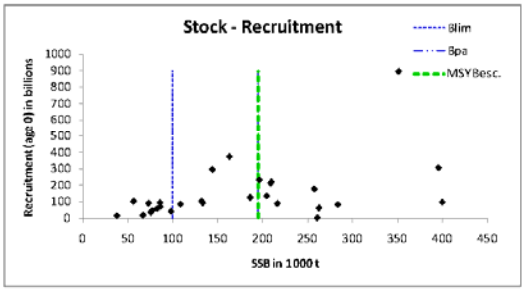



**Figure 6.4.21.3.2** Sandeel in the Central Eastern North Sea (SA3). Stock–recruitment plot

**Table 6.4.21.3.1** Sandeel in the Central Eastern North Sea (SA3). ICES advice, management and landings

| Year | ICES Advice | Catch corresponding to advice | TAC [2] | ICES Landings SA3 | ICES Landings Total |
|---|---|---|---|---|---|
| 2005 [1] | Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class | - | 661 | 30 | 172 |
| 2006 [1] | The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2007. | - | 300 | 19 | 288 |
| 2007 [1] | The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2008. | - | 173 | 114 | 206 |
| 2008 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2009. | - | 400 | 95 | 335 |
| 2009 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2010 | - | 400 | 34 | 347 |
| 2010 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2011 | - | 400 | 78 | 402 |
| 2011 | No fishery | 0 | | | |

Weights in '000 t.
[1] Advice for Subarea IV excluding the Shetland area.
[2] Set for zone IIIa, EC waters of Division IIa and Subarea IV.

**Table 6.4.21.3.4** Sandeel in the Central Eastern North Sea (SA3). Summary of the assessment.

| Year | Recruits (million) | TSB (tonnes) | SSB (tonnes) | Yield[1] (tonnes) | Mean F ages 1-2 |
|---|---|---|---|---|---|
| **1983** | 92758 | 212748 | 73212 | 105946 | 0.465 |
| **1984** | 42576 | 303276 | 98284 | 123635 | 0.498 |
| **1985** | 296767 | 256659 | 144227 | 59083 | 0.274 |
| **1986** | 373688 | 777859 | 162984 | 420341 | 0.997 |
| **1987** | 83827 | 1082840 | 283715 | 403908 | 0.906 |
| **1988** | 307226 | 655548 | 395663 | 391081 | 1.365 |
| **1989** | 105207 | 814245 | 132104 | 481893 | 1.102 |
| **1990** | 213244 | 449784 | 209168 | 219183 | 0.568 |
| **1991** | 90715 | 752755 | 216384 | 368105 | 0.728 |
| **1992** | 233592 | 396339 | 196446 | 195700 | 0.466 |
| **1993** | 221185 | 739822 | 209529 | 263954 | 0.640 |
| **1994** | 179289 | 701169 | 257567 | 444119 | 0.713 |
| **1995** | 134746 | 591643 | 204541 | 218922 | 0.482 |
| **1996** | 894735 | 776379 | 351306 | 247397 | 0.394 |
| **1997** | 63391 | 1661550 | 262786 | 604159 | 0.938 |
| **1998** | 99007 | 595816 | 399834 | 499333 | 0.940 |
| **1999** | 126854 | 405745 | 186104 | 223160 | 1.147 |
| **2000** | 87267 | 416370 | 108675 | 242732 | 1.361 |
| **2001** | 95479 | 299116 | 85852 | 245290 | 0.961 |
| **2002** | 18789 | 298045 | 67089 | 209302 | 1.066 |
| **2003** | 47851 | 126557 | 77218 | 58942 | 0.514 |
| **2004** | 16809 | 148769 | 38127 | 79234 | 0.692 |
| **2005** | 36661 | 120188 | 75562 | 29677 | 0.232 |
| **2006** | 103184 | 148729 | 56591 | 18863 | 0.138 |
| **2007** | 60029 | 360019 | 82761 | 113232 | 0.536 |
| **2008** | 94415 | 318333 | 133409 | 94491 | 0.473 |
| **2009** | 72280 | 321592 | 86326 | 33350 | 0.143 |
| **2010** | 4420 | 440423 | 260710 | 78051 | 0.525 |
| **2011** | | | 197580 | | |
| **arith. mean** | 149857 | 506154 | 174267 | 231182 | 0.688 |
| **geo. mean[1]** | 105252 | | | | |

1) Period 1983-2009

**ECOREGION** North Sea
**STOCK** Sandeel in the Central Western North Sea (SA 4)

**Advice for 2011**

For 2011, ICES advises that a catch between 5000 and 10 000 tonnes is likely to impose a low risk to the sandeel stock in area 4. This is based on precautionary considerations founded on fishery independent data indicating an increasing stock size in recent years.

To protect the stock on a local scale, management should be implemented on the area level.

**Stock status**

| F (Fishing Mortality) | 2008 | 2009 | 2010 |
|---|---|---|---|
| MSY ($F_{MSY}$) | ? | ? | ? Unknown |
| Precautionary approach ($F_{pa}$,$F_{lim}$) | ? | ? | ? Unknown |
| Qualitative evaluation | → | → | → Stable and very low |

| SSB (Spawning Stock Biomass) | 2009 | 2010 | 2011 |
|---|---|---|---|
| MSY ($B_{escapement}$) | ? | ? | ? Unknown |
| Precautionary approach ($B_{pa}$,$B_{lim}$) | ? | ? | ? Unknown |
| Qualitative evaluation | ? | ↗ | ↗ Increase |

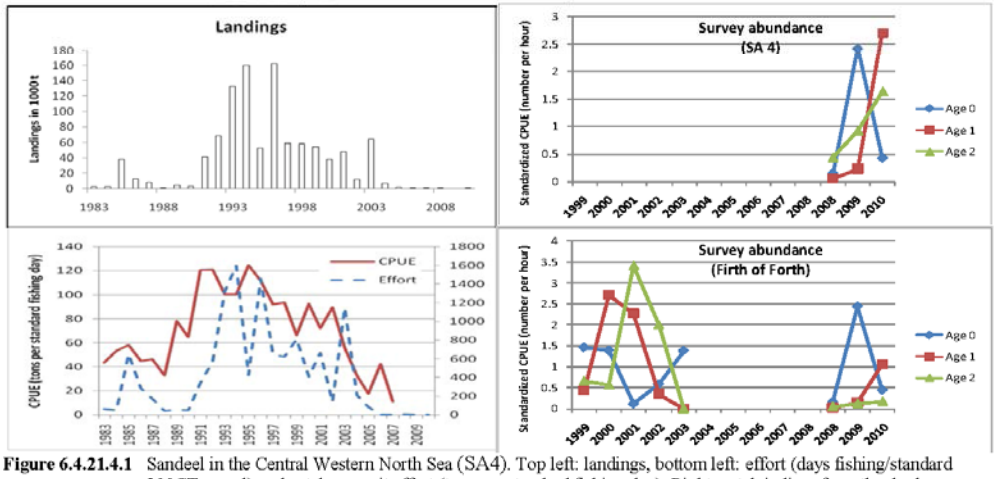



**Figure 6.4.21.4.1** Sandeel in the Central Western North Sea (SA4). Top left: landings, bottom left: effort (days fishing/standard 200GT vessel) and catch per unit effort (tons per standard fishing day). Right: catch indices from the dredge survey (number per hour standardized to mean) in the entire Area 4 (top) and in Firth of Forth only (bottom).

Catch and survey data are not sufficient to conduct a traditional age-based assessment. The result from the dredge survey indicates that recruitment (measured as cpue of 0-group) was high in 2009 and low in 2010 as observed in SA 1 and 2. Based on the 3 years of data the temporal changes in 0-group abundance for the whole area 4 appears to follow that in the Firth of Forth. The very limited effort applied in the area indicates a very low fishing mortality.

**Management plans**

No specific management objectives are known to ICES.
In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5. ICES notes that the TAC and the stock assessment areas do not match.

**Fisheries**

Because low sandeel availability affects the breeding success of kittiwake, all commercial fishing in the Firth of Forth has been prohibited since 2000, except for a limited fishery conducted in May and June to monitor the stock. This closure includes most of the fishing banks in SA 4. A few banks (e.g. Turbot bank) outside the closed area have historically provided large landings. Almost no sandeel fishery occurred in SA 4 in 2010, probably due to very high catch rates on other fishing banks closer to the landing sites in Denmark and Norway.

| | |
|---|---|
| **Catch by fleet** | Total catch (2010) 0.26 kt where 100 % landings by industrial fisheries. |

**Quality considerations**

Prior to the establishment of dedicated recruitment survey in 2008, dredge sampling intensity was low in this area. The Benchmark group (ICES, 2010) noted that because commercial fishing effort has been very low in recent years there was insufficient overlap between dredge and commercial cpue time series to provide reliable estimates of incoming 1-group strength. There are limited data to estimate the risk of overfishing, since fishing effort also depends on fishing opportunities in other areas.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Trends based assessment |
| **Input data** | 1 survey index available in January (Dredge survey)<br>Total international catch and effort |
| **Discards and bycatch** | Not included in the assessment |
| **Indicators** | None |
| **Other information** | Last benchmark in 2010. |
| **Working group report** | WGNSSK |

**ECOREGION** North Sea
**STOCK** Sandeel in the Central Western North Sea (SA 4)

**Reference points**

No reference points are defined for this stock.

**Outlook for 2011**

No forecast can be presented for this stock because catch and survey data are insufficient to conduct a traditional age-based assessment.

*PA considerations*

The fishery independent data indicate that the recruitment was high in 2009 and low in 2010 as observed in SA 1 and SA 2. Given the large 2009 year class and the moratorium of Firth of Forth since 2000, ICES advises that a TAC in the range of 5000–10 000 t is likely to imply a low risk of overfishing while allowing catches at the low end of the historical range.

*Policy paper*

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 5, because this is a short-lived species. ICES notes that the TAC and the stock assessment areas do not match.

**Additional considerations**

It is important to continue the Scottish dredge survey in this area, even though the overlap between this survey and the commercial cpue time series is currently too short to provide reliable estimates of incoming 1-group strength. Little or no information is available for this area from the in-year monitoring system in recent years because of low fishing effort. Until there is sufficient overlap in the time series of dredge survey and commercial data there will be no scientific basis to present a catch forecast.

**Sources**

ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.
ICES. 2011. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, ICES CM 2010/ACOM13.

**Table 6.4.21.4.1** Sandeel in the Central Western North Sea (SA4). ICES advice, management and landings

| Year | ICES Advice | Catch corresponding to advice | TAC [2] | ICES Landings SA4 | ICES Landings Total |
|---|---|---|---|---|---|
| 2005 [1] | Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class | - | 661 | 1.49 | 172 |
| 2006 [1] | The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2007. | - | 300 | 0.09 | 288 |
| 2007 [1] | The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2008. | - | 173 | 0.01 | 206 |
| 2008 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2009. | - | 400 | 1.20 | 335 |
| 2009 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2010 | - | 400 | 0 | 347 |
| 2010 [1] | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2011 | - | 400 | 0.26 | 402 |
| 2011 | A TAC at 5000 – 10 000 tonnes will impose a low risk of overfishing sandeel in area 4. | 5-10 | | | |

Weights in '000 t.
[1] Advice for Subarea IV excluding the Shetland area.
[2] Set for zone IIIa, EC waters of Division IIa and Subarea IV.

**Table 6.4.21.4.2** Sandeel in the Central Western North Sea (SA4). Abundance index (average CPUE) from the Scottish December dredge survey for a) the whole area 4 and b) Firth of Forth. No data were collected in 2004–2007.

| | **a) Area 4** | | | **b) Firth of Forth** | | |
|---|---|---|---|---|---|---|
| **Year** | **Age 0** | **Age 1** | **Age 2** | **Age 0** | **Age 1** | **Age 2** |
| 1999 | | | | 615 | 494 | 301 |
| 2000 | | | | 586 | 3170 | 258 |
| 2001 | | | | 48 | 2656 | 1561 |
| 2002 | | | | 243 | 404 | 916 |
| 2003 | | | | 580 | | |
| 2004-2007 | - | - | - | - | - | - |
| 2008 | 52 | 24 | 18 | 68 | 24 | 24 |
| 2009 | 832 | 87 | 38 | 1023 | 174 | 56 |
| 2010 | 147 | 1032 | 67 | 186 | 1244 | 78 |

**ECOREGION** North Sea
**STOCK** Sandeel in the Viking and Bergen Bank area (SA 5)

**Advice for 2011**

There is no basis for an advice. Therefore no increase of the fisheries should take place unless there is evidence that this will be sustainable.

**Stock status**

| F (Fishing Mortality) | 2008 | 2009 | 2010 |
|---|---|---|---|
| MSY ($F_{MSY}$) | ? | ? | ? Unknown |
| Precautionary approach ($F_{pa}$,$F_{lim}$) | ? | ? | ? Unknown |

| SSB (Spawning Stock Biomass) | 2009 | 2010 | 2011 |
|---|---|---|---|
| MSY ($B_{escapement}$) | ? | ? | ? Unknown |
| Precautionary approach ($B_{pa}$,$B_{lim}$) | ? | ? | ? Unknown |

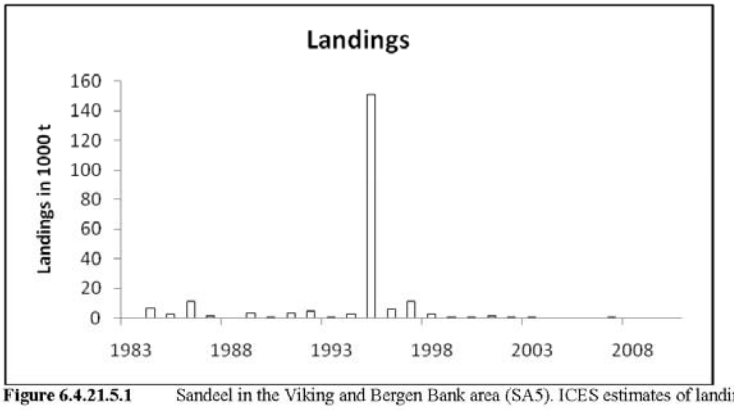



**Figure 6.4.21.5.1** Sandeel in the Viking and Bergen Bank area (SA5). ICES estimates of landings (in '000 tonnes).

Catch statistics and acoustic data are available for this stock. The available information is inadequate to evaluate stock status or trends. The state of the stock is therefore unknown.

**Management plans**

No specific management objectives are known to ICES.

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 11. ICES notes that the TAC and the stock assessment areas do not match.

| **Catch by fleet** | Total catch (2010) 0 kt |
|---|---|

**Scientific basis**

| | |
|---|---|
| **Assessment type** | No assessment |
| **Input data** | Catch statistics |
| **Discards and bycatch** | Not included in the assessment |
| **Indicators** | Acoustic measurements in the Norwegian zone |
| **Other information** | Last benchmark in 2010. |
| **Working group report** | WGNSSK |

**ECOREGION** North Sea
**STOCK** Sandeel in the Viking and Bergen Bank area (SA 5)

**Reference points**

No reference points are defined for this stock.

**Outlook for 2011**

No forecast can be presented for this stock because the available data are insufficient to conduct an analytical assessment.

*Policy paper*

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock assessment area is classified under category 11 because there is no TAC advice for this area. ICES notes that the TAC and the stock assessment areas do not match.

**Additional considerations**

Norway has closed fisheries on the Viking Bank Area in 2011 because of very low estimates of sandeel abundance as measured using acoustics in 2007–2010 (ICES, 2010b).

**Sources**

ICES. 2010a. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 5-11 May 2010 ICES CM 2010/ACOM13.
ICES. 2010b. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.

**ECOREGION** North Sea
**STOCK** Sandeel in Division IIIa East (Kattegat, SA6)

**Advice for 2011**

There is no basis for an advice. Therefore no increase of the fisheries should take place unless there is evidence that this will be sustainable.

**Stock status**

| F (Fishing Mortality) | 2008 | 2009 | 2010 |
|---|---|---|---|
| MSY ($F_{MSY}$) | ? | ? | ? Unknown |
| Precautionary approach ($F_{pa}$,$F_{lim}$) | ? | ? | ? Unknown |

| SSB (Spawning Stock Biomass) | 2009 | 2010 | 2011 |
|---|---|---|---|
| MSY ($B_{escapement}$) | ? | ? | ? Unknown |
| Precautionary approach ($B_{pa}$,$B_{lim}$) | ? | ? | ? Unknown |

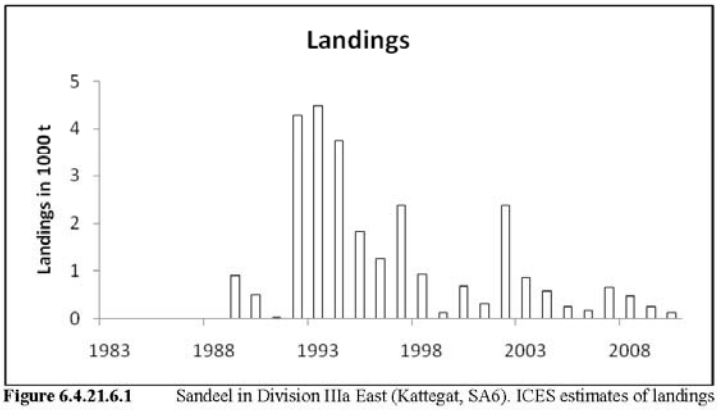



**Figure 6.4.21.6.1** Sandeel in Division IIIa East (Kattegat, SA6). ICES estimates of landings (in '000 tonnes).

Only catch statistics are available for this stock. The available information is inadequate to evaluate stock status or trends. The state of the stock is therefore unknown.

**Management plans**

No specific management objectives are known to ICES.

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 11. ICES notes that the TAC and the stock assessment areas do not match.

| | |
|---|---|
| **Catch by fleet** | Total catch (2010) 0.1 kt where 100% landings by industrial fisheries |

**Scientific basis**

| | |
|---|---|
| **Assessment type** | No assessment |
| **Input data** | Catch statistics |
| **Discards and bycatch** | Not included in the assessment |
| **Indicators** | None |
| **Other information** | Last benchmark in 2010 |
| **Working group report** | WGNSSK |

**ECOREGION** North Sea
**STOCK** Sandeel in Division IIIa East (Kattegat, SA6)

**Reference points**

No reference points are defined for this stock.

**Outlook for 2011**

No forecast can be presented for this stock because the available data are insufficient to conduct an analytical assessment.

*Policy paper*

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock assessment area is classified under category 11 because there is no advice for this area. ICES notes that the TAC and the stock assessment areas do not match.

**Sources**

ICES. 2010. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 5-11 May 2010 ICES CM 2010/ACOM13.

**ECOREGION** North Sea
**STOCK** Sandeel in the Shetland area (SA 7)

**Advice for 2011**

There is no basis for an advice. Therefore no increase of the fisheries should take place unless there is evidence that this will be sustainable.

**Stock status**

| F (Fishing Mortality) | 2008 | 2009 | 2010 |
|---|---|---|---|
| **MSY ($F_{MSY}$)** | ? | ? | ? Unknown |
| **Precautionary approach ($F_{pa}$,$F_{lim}$)** | ? | ? | ? Unknown |

| SSB (Spawning Stock Biomass) | 2009 | 2010 | 2011 |
|---|---|---|---|
| **MSY ($B_{escapement}$)** | ? | ? | ? Unknown |
| **Precautionary approach ($B_{pa}$,$B_{lim}$)** | ? | ? | ? Unknown |

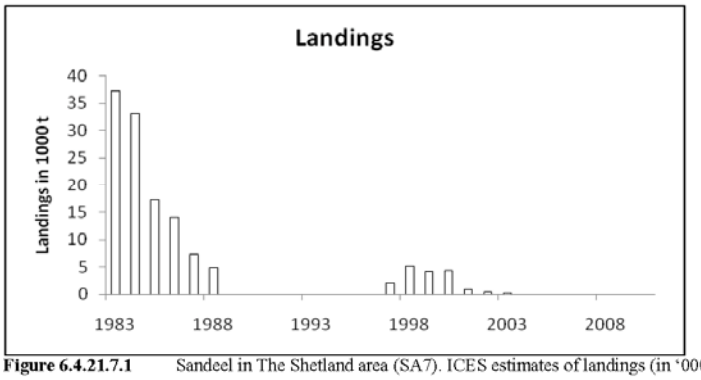



**Figure 6.4.21.7.1** Sandeel in The Shetland area (SA7). ICES estimates of landings (in '000 tonnes).

Catch statistics and trawl survey data are available for this stock. The available information is inadequate to evaluate stock status or trends. The state of the stock is therefore unknown.

**Management plans**

Since 2007, a national management plan has regulated the inshore sandeel fisheries. This plan takes account of both fisheries and wildlife conservation concerns. ICES has not evaluated the management plan.

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 11.

| | |
|---|---|
| **Catch by fleet** | Total catch (2010) 0 kt |

**Scientific basis**

| | |
|---|---|
| **Assessment type** | No assessment |
| **Input data** | Catch statistics |
| **Discards and bycatch** | Not included in the assessment |
| **Indicators** | Stock monitoring took place between 1985-2007 by a trawl survey |
| **Other information** | Last benchmark in 2010 |
| **Working group report** | WGNSSK |

**ECOREGION** North Sea
**STOCK** Sandeel in the Shetland area (SA 7)

**Reference points**

No reference points are defined for this stock.

**Outlook for 2011**

No forecast can be presented for this stock because the available data are insufficient to conduct an analytical assessment.

***Management plan***

A national management plan has been in place for this stock since 2007. Sandeel fishing around Shetland is restricted to small inshore grounds. The fishery is managed by the Scottish Government. Since 2007 the management regime has included (a) a precautionary TAC of 1000 tonnes; (b) closure of grounds south of 60° 10′ N, including around Foula and Fair Isle; (c) a seasonal closure of the fishery in June and July during the chick rearing period of seabirds and (d) a vessel length restriction of 20 metres. ICES has not evaluated this management plan.

***Policy paper***

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock assessment area is classified under category 11 because there is no advice for this area.

**Sources**

ICES. 2010. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 5–11 May 2010 ICES CM 2010/ACOM13.

**European Commission**

**EUR 24751 EN – Joint Research Centre – Institute for the Protection and Security of the Citizen**
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**Abstract**
The Scientific, Technical and Economic Committee for Fisheries gave its opinion by written procedure in February 2011 on request by the European Commission on in-year management advice for sandeel in the North Sea and Skagerrak.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

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